

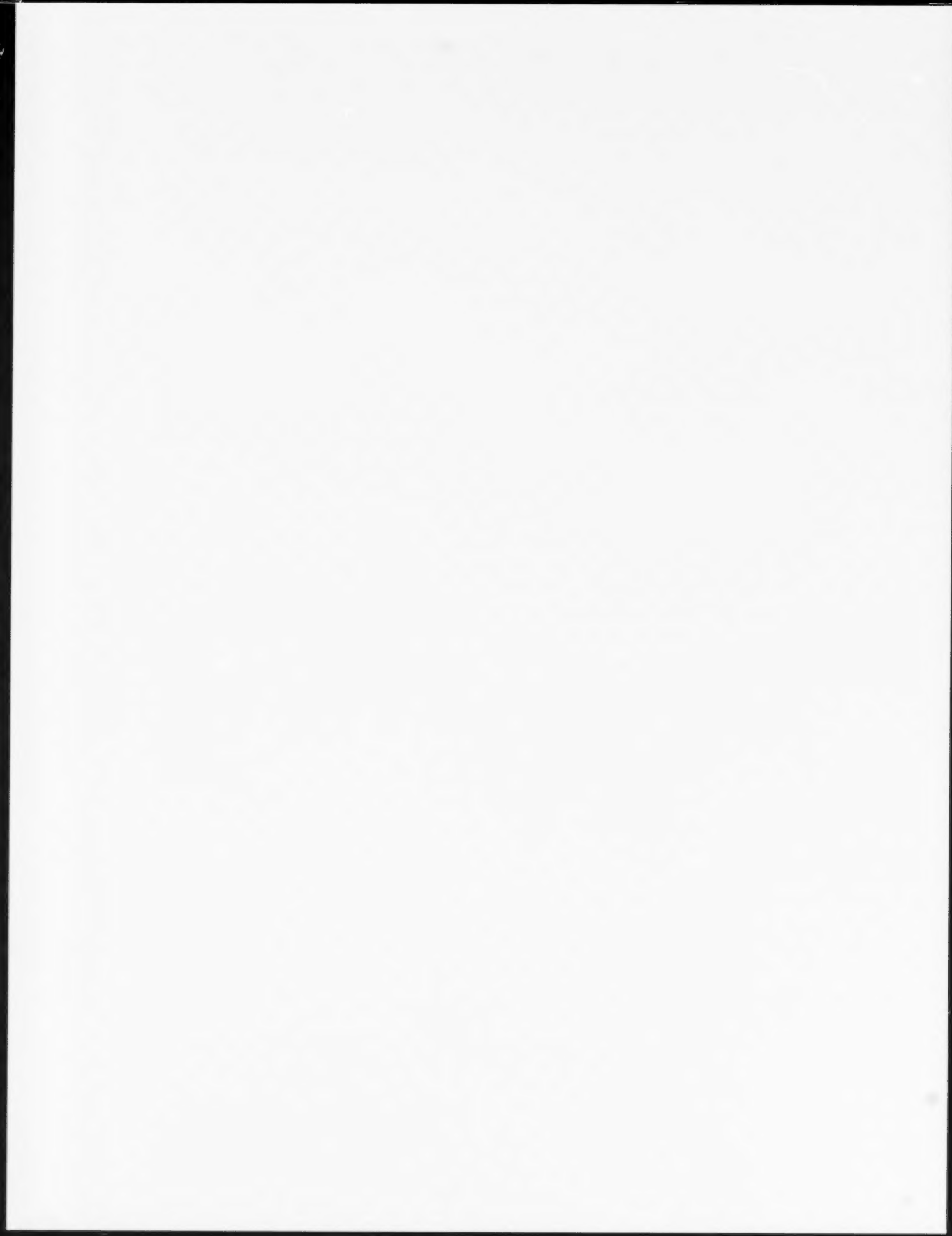
# 2011


## Annual Report

### Forest Health in Alberta



*Alberta*   
Government





## 2011 Annual Report

### Forest Health Program Sustainable Resource Development

#### *Forest Health Vision*

To lead Canada in science-based, proactive, adaptive and innovative management of damaging forest health agents in a forest environment with a multitude of values and challenges posed by a changing climate.

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Cover Photo: Spruce budworm infested white spruce

# 2011 Annual Report

## Forest Health in Alberta

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In 2011, Sundre Forest Products and Hinton Wood Products helped with the mountain pine beetle dispersal baits program; Canfor and ANC Timber Limited worked through the Forest Resource Improvement Association of Alberta (FRIAA) to help level 1 control of mountain pine beetle. Manning Diversified Forest Products and Tolko Industries – High Level participated in monitoring male spruce budworm moth populations in Northwest Alberta.

Aaron McGill (Senior Information Management Technologist) prepared the maps included in this report.

Alberta Agriculture and Foods, Bugwood, Daniel Lux, Brooks Horne, Marian Jones, Mike Maximchuk and Tom Hutchison provided the photographs that appear in this report.

Gwen Edge (Graphic Designer, Communications) designed and published the report.

## Executive Summary

This is the 2011 annual report of the Forest Health Program, Forestry Division of Alberta Sustainable Resource Development.

In 2011, bark beetles, spruce budworms, aspen defoliators, invasive plants and some abiotic damaging agents such as drought, red belt and die-back were the major forest pests of concern in Alberta.

In the 2010 beetle year there was no evidence of a major influx of beetles into the province although the long-distance aerial dispersal monitoring indicated further eastward and northward spread. The results of the green: red ratio and r-value surveys carried out in 2010 beetle year were forecasting a decrease in pine beetle infestations in southern Alberta and along the leading edge of the infestation where control actions were implemented; however, beetles appeared to be doing well in parts of northwest Alberta.

Under the level 1 single tree treatment beetle-focussed strategy, 177,039 infested trees were treated in the 2010 beetle year. Another 4,242 beetle-infested trees were removed under the municipal grant program.

The eastern spruce budworm infestations decreased in extent and severity in 2011. Compared to the budworm defoliated area recorded in 2010, the budworm defoliated area in 2011 decreased by 87 per cent to reach 35,403 hectares; the severely defoliated area decreased 97 per cent to reach 3,208 hectares and the moderately defoliated area decreased 65 per cent to reach 32,195 hectares. The moth surveys carried out in 2011 forecasted a decrease in the likelihood of new infestations occurring in 2012. Based on the results of the egg mass- and second instar larval surveys, the proposed 2011 aerial spray program to manage spruce budworm populations in northeast Alberta was scaled down. A biological insecticide was aerially sprayed over 2,750 hectares

of infested white spruce stands to protect silvicultural, industrial and social values of the affected stands. This spraying reduced the budworm population by over 80 percent thus helping to achieve the goal of keeping the infested trees alive to recover.

The western spruce budworm defoliated area in southwest Alberta more than doubled from 2,893 hectares recorded in 2010 to 6,914 hectares in 2011.

Aspen defoliation caused by insect pests increased by about 46 per cent in 2011 compared to that in 2010. This defoliation was scattered over an estimated 91,214 hectares compared to 62,658 hectares defoliated in 2010. The forest tent caterpillar was the predominant defoliator of aspen in Alberta in 2011; the Bruce spanworm and the large aspen tortrix were the other major defoliators of aspen in the province in 2011.

Extensive drought-damaged aspen scattered over about 400,000 hectares was recorded during aerial overview surveys carried out in 2011 in the Lower Athabasca, Lower Peace and Upper Peace Land-Use Framework (LUF) regions. Aspen dieback and wind damage were found in the Upper Athabasca, Upper Peace and South Saskatchewan LUF regions. Red belt was common along the eastern slopes of the Rockies.

The monitoring of major invasive plant species in selected parts of the "Green Area" showed that Canada thistle, tall buttercup and ox-eye daisy were the predominant species in 2011. This year, the Forest Health Section carried out several invasive plant management programs in Crown lands in the "Green Area." Several successful invasive plant management programs were carried out in 2011 in cooperation with forest companies; oil and gas companies, municipal districts and counties. SRD either organized or carried out workshops, courses and demonstrations to increase invasive plant awareness of the SRD and



industry personnel. New signs were erected in 2011 at strategic locations in the "Green Area" to increase public awareness on invasive plant species.

In 2011, under collaborative programs, the Forest Health Section: a) was involved with other agencies in whitebark pine and limber pine recovery programs; b) deployed 55 baited-traps, as part of a program by the Canadian Food Inspection Agency, to detect the presence of gypsy moths in the province; no gypsy moths were detected at these trap locations; and, c) monitored sites set up to study "Climate Impact on the Productivity and Health of Aspen", under a Letter of Agreement with Natural Resources Canada.

To increase Forest Health awareness, the Forest Health Section conducted a three-day workshop on mountain pine beetle sponsored by the Canadian Council of Forest Ministers under the National Forest Pest Strategy. This workshop was well received by forest management executives and professionals who attended this event from across Canada. The 2011 Provincial Forest Pest Management Forum was held at the Northern Forestry Centre in Edmonton under the auspices of the Forest Health Section. This Forum dealt with current forest health conditions and research in the province. It was attended by personnel representing the federal, provincial and municipal governments, forest industry and academia who shared a common interest in forest health issues of Alberta. The Forest Health Newsletter "Bugs and Diseases," a popular source of information with the provincial Forest Health Community, was published quarterly.

In summary, the 2011 annual report illustrates that the Forest Health Program met Strategy 3.1 under SRD Business Goal 3, i.e.,

*".....Implement pre-emptive strategies in Alberta's forests to maintain their health and manage infestations of disease, invasive plants and insect pests, such as the mountain pine beetle, in cooperation with industry and municipal and federal governments."*



## Introduction

This report provides information on programs carried out by the Forest Health Section of Alberta Sustainable Resource Development (SRD) to meet its business goals in 2011. Details of other Forest Health-related programs in Alberta that are either linked to or have a direct bearing on programs carried out by the Forest Health Section are also reported.

All technical details regarding survey procedures and standards are available from the Forest Health Section of the Forest Management Branch, Alberta Environment and Sustainable Resource Development.

This report outlines details of:

1. The mountain pine beetle (MPB) program including surveys to detect long-distance dispersal of the beetle, population trends and pine trees with red crowns symptomatic of MPB attack, and the level 1 single tree treatment beetle-focussed control program.
2. Occurrence of other bark beetles of concern.
3. The eastern- and western spruce budworms that are the main defoliators of conifers, their distribution, population trends, extent and severity of damage, and control.
4. The extent and severity of damage of the major aspen defoliators.
5. Abiotic forest damaging agents including drought that affected aspen, red belt that affected pines along the Rockies, and aspen dieback.
6. Invasive plant species program including education, surveys and management programs at selected locations in the Green Area.
7. Collaborative programs with other agencies, and programs to increase forest health awareness in the province.

Forest pest-related data are reported on a "Land-Use Framework (LUF) Region" basis. The LUF regions in Alberta are shown in Appendix I.

The surveys reported in this document were carried out for operational purposes over forested Crown land in Alberta. These surveys do not necessarily cover the entire provincial land base. Although every effort has been made to ensure accuracy and completeness of this report, its integrity is not guaranteed by SRD.



## Forest Pest Conditions and Management Programs in 2011

### Bark Beetles

#### Mountain Pine Beetle, *Dendroctonus ponderosae*

##### Introduction

The objectives, goals and expected outcomes of Alberta's mountain pine beetle (MPB) management program are outlined in the MPB Management Strategy.

The mountain pine beetle management program began in earnest in 2002 with the detection of green attack trees on SRD-managed forested Crown land. Figure 1 depicts spatial distribution of suspected MPB-infested pine trees on forested Crown land in Alberta from 2005 through 2010.

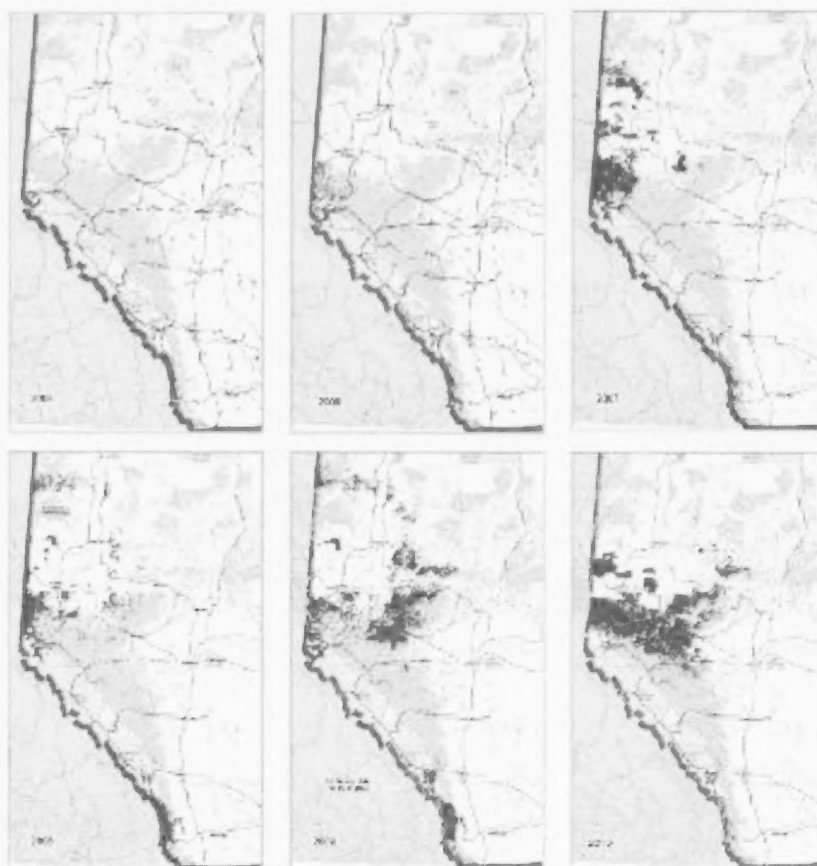


Figure 1.

Aerial survey maps showing spatial distribution of pine trees with red crowns symptomatic of mountain pine beetle attacks in 2005-2010<sup>1</sup>, Alberta.

<sup>1</sup> 2010 map is based on Heli-GPS surveys carried out in fall 2009. The 2010 survey did not cover some parts of the Inactive Holding Zone in the Smoky Area of the Upper Peace LUF Region and in the Upper Hay Area of the Lower Peace LUF Region.

This report includes activities managed by the Forest Health Section of the Forest Management Branch and is composed of:

- Detection and assessment of current infestations
- Action to manage the MPB
- Forecasting population trends

Details of the 2010 MPB program reported here cover the period from August 15, 2010 to August 14, 2011. This time period approximately coincides with the new generation of MPB emerging from eggs laid following beetle flights in 2010 summer through their development and resulting flights as adult beetles in 2011 summer.

### Detection and Assessment of Infestations

#### Long-Distance Dispersal Monitoring

Plots with aggregation pheromone-baited trees were established in June 2010, i.e., before the 2010 beetle flights, and monitored from July through September to detect long-distance aerial dispersal of beetles in Alberta. In each strategically pre-selected township a beetle monitoring plot was set up in a highly MPB-susceptible pine stand. In September 2010, the baited-trees were checked for presence of MPB hits.

Figure 2 shows locations of baited-trees with MPB hits in long-distance dispersal monitoring plots, following 2010 MPB flights. MPB hits were observed in some plots located further east than before in the Lac La Biche and Waterways areas of the Lower Athabasca LUF Region in northeast Alberta. These imply further eastward expansion of MPB infestations than before. Similarly, this map shows MPB hits in monitoring plots located further north than ever before in the Upper Hay Area of the Lower Peace LUF Region.

In June 2011, MPB-attacked pine trees with live beetles were detected even further north in Twp 116-06-W6 about 13 km southwest of Zama City (Mike Maximchuk, Forest Health Officer, personal communication). This location is north of the 59th parallel, about 100 km south of the Northwest Territories Border.



MPB pitch tubes



MPB-infested pine tree near Zama City, Alberta



Figure 2.  
Results of the MPB long-distance aerial dispersal monitoring carried out from July to September 2010 in Alberta.



### Overview Aerial Detections

From 2010 August 15 through September 15, heli-GPS surveyors recorded locations of pine trees with red crowns symptomatic of MPB infestations. In the Lesser Slave, Woodlands and Smoky areas these surveys were supplemented by aerial photography to detect pine trees symptomatic of MPB attack.

Figure 3 shows the combined number of pine trees symptomatic of MPB, detected by aerial detection surveys (heli-GPS surveys and aerial photography) in 2010. Compared to the corresponding results in 2009 (Figure 4), the results of 2010 surveys show a marked decline in the number of pine trees symptomatic of MPB attacks in southwest Alberta. This decline is most likely due to a) aggressive beetle control action; b) lack of MPB influx from British Columbia; and, c) later than normal MPB flights that likely resulted in high overwintering mortality caused by a cold snap in October and  $-40^{\circ}\text{C}$  temperature in December (Brad Jones, Forest Health Officer, personal communication).

However, areas with MPB symptomatic trees expanded particularly in the 2009 Holding Zone where only limited control action was taken. These include parts of the Lesser Slave, Foothills and Woodlands areas of the Upper Athabasca LUF Region and the Clearwater Area of the North Saskatchewan LUF Region. The area with pine trees symptomatic of the MPB increased substantially in the Inactive Holding Zone in the Smoky Area of the Upper Peace LUF Region and in the Peace Area of the Lower Peace LUF Region where no control actions were taken. The Cypress Hills Inter-Provincial Park in southeast Alberta also had pine trees with MPB attack symptoms. This park, isolated from the rest of the forested area in the province, has had an endemic MPB population since the last major outbreak in 1970s.



MPB galleries with pupal chambers



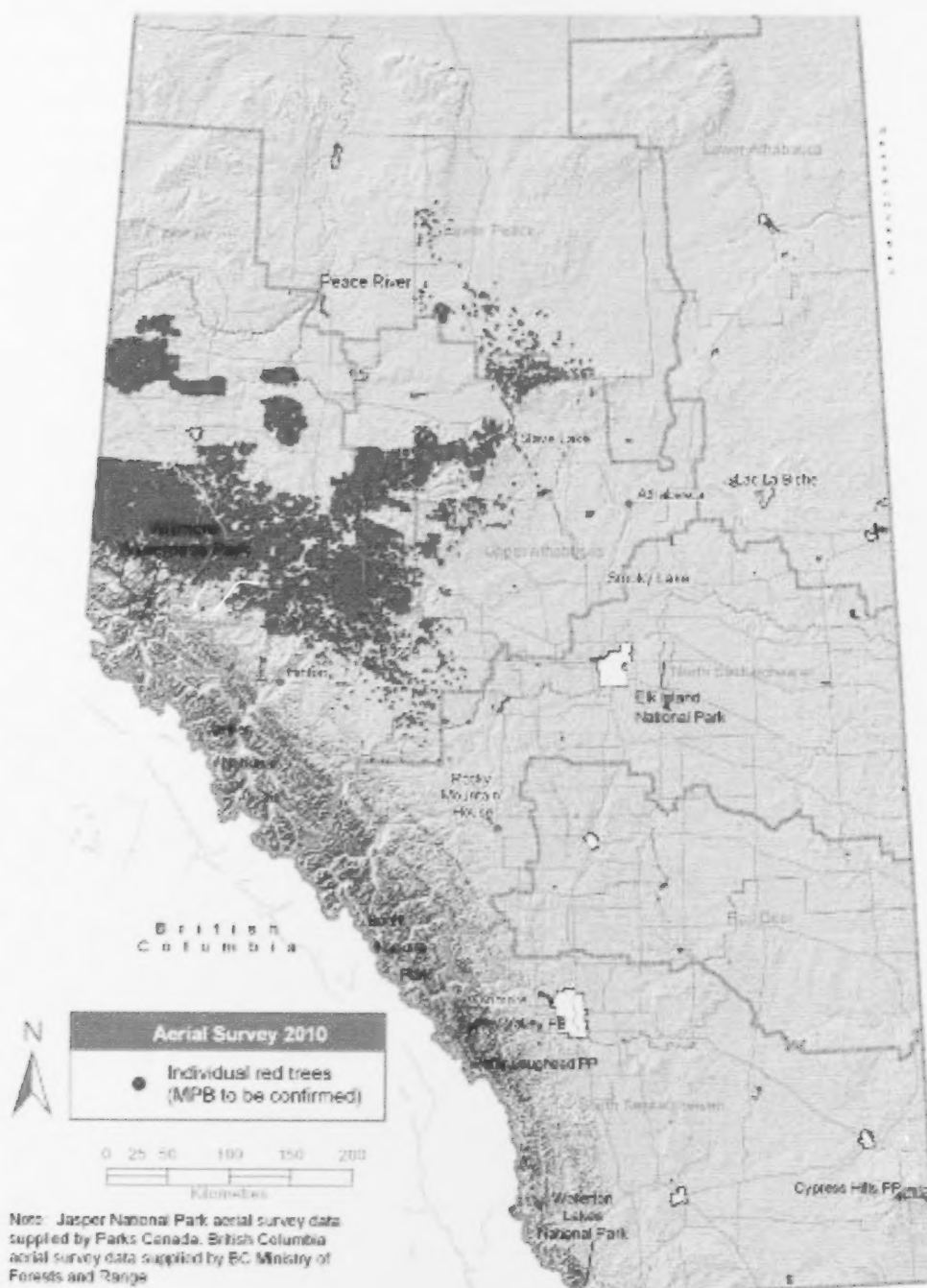


Figure 3. Results of the aerial detection surveys showing locations of pine trees symptomatic of mountain pine beetle attacks in Alberta<sup>2</sup>, fall 2010.

<sup>2</sup> Heli-GPS surveys of MPB symptomatic pine trees carried out in 2010 did not cover parts of the Inactive Holding Zone in the Smoky Area of the Upper Peace LUF Region and in the Upper Hay Area of the Lower Peace LUF Region.

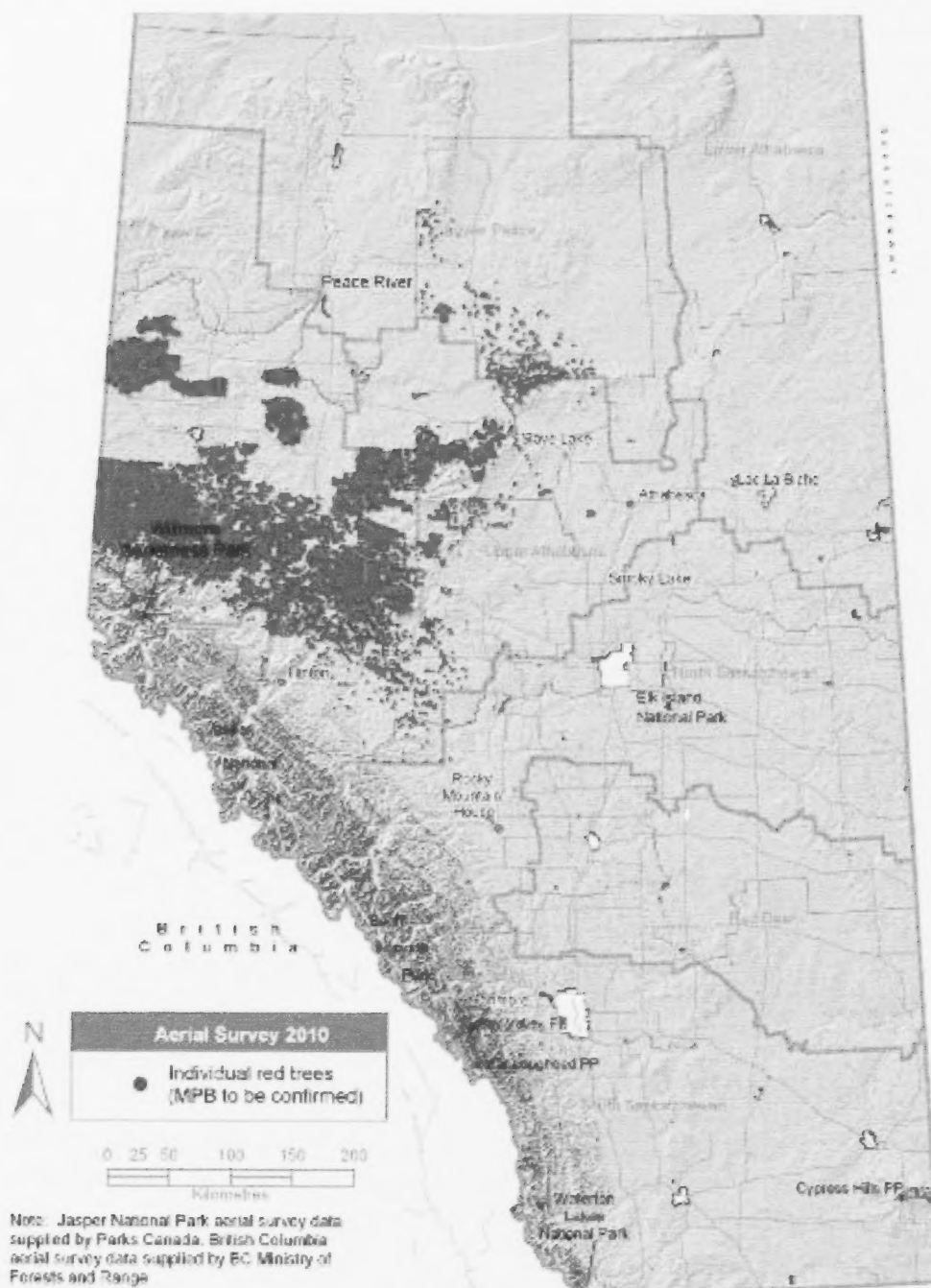


Figure 4.  
Results of the Heli-GPS surveys showing locations of pine trees symptomatic of mountain pine beetle attacks in Alberta<sup>3</sup>, fall 2009.

<sup>3</sup> Heli-GPS surveys of MPB symptomatic pine trees carried out in 2009 did not cover parts of the Inactive Holding Zone in the Smoky Area of the Upper Peace LUF Region and in the Upper Hay Area of the Lower Peace LUF Region.

### Green: Red Ratios

The green: red ratios are the ratios of currently attacked trees with green crowns (green attacks) to trees with one-year old attacks showing red crowns (red attacks). A green: red ratio of  $>1$  indicates an increasing population, a ratio of 1 indicates a static population and a ratio of  $<1$  indicates a declining population.

Figure 5 shows the green: red ratios in 548 plots surveyed in Alberta during September 1-15, 2010.

The green: red ratios confirmed declining MPB populations in southern Alberta. In northern Alberta, low green: red ratios in many areas surveyed indicated declining MPB populations. However, high green: red ratios indicated patches of increasing MPB populations mainly in the Upper Peace and Lower Peace LUF regions.

### Ground Surveys to Detect Green Attacks

Ground surveys were carried out in fall 2010 to detect green attacks in areas earmarked for beetle management. These surveys were based on locations of pine trees with red crowns that were detected during heli-GPS surveys and aerial photography carried out in 2010 fall. Altogether 16,842 concentric surveys were carried out to detect green attack trees.



Figure 5.  
Results of the fall 2010 green: red ratio surveys carried out in Alberta.

### Level 1 Single Tree Treatment MPB Management Program

A Decision Support System (DSS), supported by a Geographical Information System (GIS), is in place to prioritize MPB-infested areas for control. This system helps forest managers in deciding which areas are to be treated to meet provincial objectives. This DSS, based on beetle biology and risk of spread, was used to categorize beetle-infested stands into five levels of risk varying from very low; low; moderate; high to extreme by using green: red ratios to calculate the potential number of green trees at each site. All the sites with moderate, high or extreme risk are controlled. In the Inactive Holding Zone SRD did not carry out either surveys or control actions (Figure 6).

Under the level 1 single tree treatment "Beetle-focused Strategy," 177,039 beetle-infested trees were treated. The results of this control program are shown in Table 1.

Table 1.

The number of beetle-infested pine trees that were removed under SRD/FRIAA<sup>1</sup> MPB control program in the 2010 beetle-year in Alberta

Corporate Area	Number of trees felled and burned or chipped
Southern Rockies	166
Clearwater	54
Foothills	3,659
Woodlands	17,082
Smoky	149,805
Lesser Slave	6,273
<b>Total</b>	<b>177,039</b>



Burning of MPB-infested logs

<sup>1</sup>Forest Resource Improvement Association of Alberta





Figure 6.  
MPB management zones in Alberta in the 2010 beetle year.



In addition, SRD provided grants to seven municipalities to remove MPB-infested trees on land under their jurisdictions. Under this program, 4,242 MPB-infested trees were removed in the 2010 beetle year. The details of this program are shown in Table 2.

Table 2.

Number of MPB-infested trees controlled under the municipal grant program in the 2010 beetle year in Alberta

Municipality	No. of MPB-infested trees removed
County of Grande Prairie	4,131
Town of Whitecourt	11
MD of Crowsnest Pass	11
Canmore Corridor	4
Woodlands County	5
Town of Edson	6
Yellowhead County	74
<b>Total</b>	<b>4,242</b>

## Forecasting Population Trends

### R-values

The r-value is a measure of the relative status of MPB populations. The r-value at a given site is the standardized average ratio of the number of beetles that entered the bark samples of pre-determined size taken from the boles of infested trees, to the number of live MPB brood found in those samples. The r-values were determined in 208 plots, from May 15 through June 15, 2011, after control operations were completed.

Based on r-values, either declining or static MPB populations are projected in most of the Leading Edge Zone (Figure 7) where aggressive control action was taken in 2010. These included parts of the Upper Athabasca, Upper Peace and Lower Peace, North Saskatchewan and South Saskatchewan LUF regions. This decline is most likely due to a) aggressive control action, b) lack of MPB influx from British Columbia; and, c) later than normal MPB flights that likely resulted in high overwintering mortality caused by a cold snap in October and -40°C temperature in December (Brad Jones, Forest Health Officer, personal communication).

Patches of highly to extremely successful MPB populations are projected in the Holding Zone with limited control action and in the Inactive Holding Zone (Figure 7) for the 2010 beetle year with no control action in the Upper Peace and the Lower Peace LUF regions. Extremely successful patches of MPB populations are projected in south and east of Grande Prairie in the Smoky Area and areas west of Highway 35 north of the Town of Peace River in the Peace Area of the Upper Peace LUF Region, (Figure 7). MPB populations in other infested areas are projected to be moderately successful. Based on these observations, MPB population growth is expected to be declining in southwest Alberta but increasing in the Upper Peace and Lower Peace LUF regions in northwest Alberta.

## Other Bark Beetles

### Forecasting Population Trends

In 2011, a light infestation of the balsam bark beetle, *Dryocoetus confusus*, was reported over an estimated 11 hectares in the Upper Peace LUF Region. A moderate infestation of Douglas fir beetle, *Dendroctonus pseudotsugae*, was observed over an estimated 1.4 hectares of Douglas fir in the South Saskatchewan LUF Region.



Figure 7.  
Forecast on MPB populations, based on results of r-value surveys conducted in Alberta, spring 2011.

## Conifer Defoliators

### Spruce Budworms, *Choristoneura* spp.

#### Eastern Spruce Budworm

##### Detection and Assessment

Each year, Forest Health Officers and/or Technicians carry out aerial surveys to monitor the extent and severity of spruce budworm infestations on forested Crown land. The goals of this program are twofold:

1. To keep a historical record of these infestations; and,
2. To assess the need to take management actions if spruce budworm infestations could compromise management objectives of the affected lands.

The results of these surveys are shown in Figure 8. The aerially visible defoliation in northern Alberta shown in this figure was caused by the eastern spruce budworm, *C. fumiferana*. The eastern spruce budworm defoliated an estimated net area of 35,403 hectares of white spruce stands. This is an 86.9 per cent decrease of budworm defoliated area that covered 269,365 hectares in 2010. Defoliation was severe over 3,208 hectares (9.1 per cent) and moderate over 32,195 hectares (90.9 per cent). Thus, between 2010 and 2011, severely defoliated area decreased from 178,585 hectares to 3,208 hectares (98.2 per cent) and moderately defoliated area decreased from 90,780 hectares to 32,195 hectares (64.5 per cent) (Figure 8 and Table 3).

In the Lower Athabasca LUF Region spruce budworm defoliation collapsed from 95,575 hectares of severe and 3,318 hectares of moderate defoliation in 2010 to a mere 4,431 hectares with moderate defoliation in 2011. There was no aerially visible budworm defoliation in 2011 in the Upper Athabasca LUF Region, which had 2,146 hectares of budworm defoliation in 2010. In the Lower Peace LUF Region, between 2010 and 2011, severe budworm defoliation dropped from 82,702 hectares to 3,208 hectares (96.1 per cent) and moderate budworm defoliation

dropped from 85,624 hectares to 27,764 hectares (67.6 per cent).

Figure 10 shows the five-year trend in eastern spruce budworm defoliation in Alberta. This figure shows a dramatic decrease in the extent and severity of defoliation in 2011. This decrease was attributed to cold weather conditions that resulted in late spring frost in 2011 thus lowering budworm populations in the Lower Peace LUF Region. In the Lower Athabasca and Upper Athabasca regions this decrease was attributed to unusually wet weather from June through August in 2010 that interfered with moth dispersal, mating and oviposition processes thus lowering the budworm populations.



Figure 8.  
Spatial distribution of aerially visible eastern spruce budworm defoliation over forested Crown land surveyed in Alberta, 2011.



Severely budworm-defoliated white spruce shoot

Table 3.

The extent (ha) of spruce budworm defoliation recorded under each severity category during aerial surveys carried out in Alberta, 2010 vs. 2011

	2009	2010	Change <sup>2</sup>
Moderate	90,782	32,195	64.5 per cent
Severe	178,585	3,208	98.2 per cent
Total	269,367	35,403	86.9 per cent

<sup>2</sup> Percent decline in the defoliated area in 2011 compared to the corresponding area in 2010

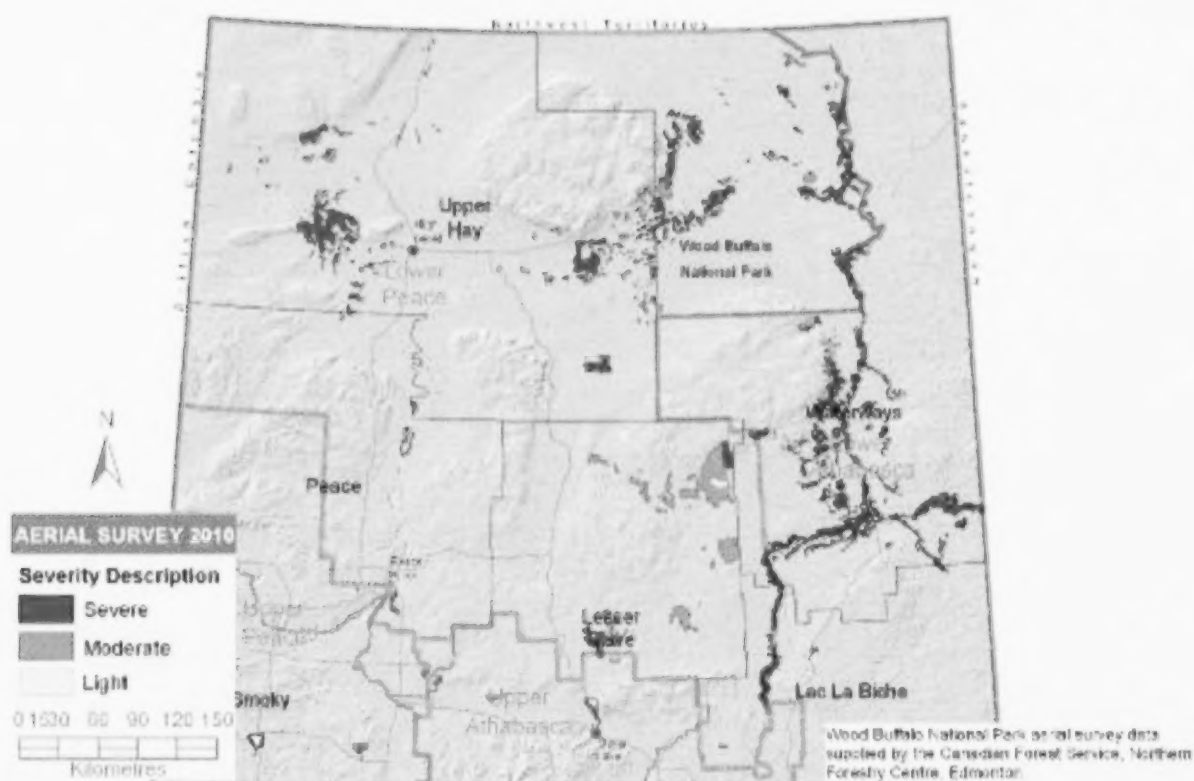


Figure 9.

Spatial distribution of aerially visible eastern spruce budworm defoliation over forested Crown land surveyed in Alberta, 2010.



Table 4 shows the extent of spruce budworm defoliated areas, by severity categories, in the LUF regions.

Table 4.

The extent (ha) of spruce budworm defoliation recorded under each severity category in 2011 in the Land-Use Framework regions of Alberta.

LUF Region	Corporate Area/s	Extent of Defoliation (ha)		Total
		Moderate	Severe	
Lower Athabasca	Lac La Biche Waterways	4,431	0	4,431
Lower Peace	Lac La Biche Lesser Slave Peace Upper Hay Waterways	27,764	3,208	30,972
<b>Sub-Total</b>		<b>32,195</b>	<b>3,208</b>	
<b>Grand Total</b>		<b>35,403</b>		

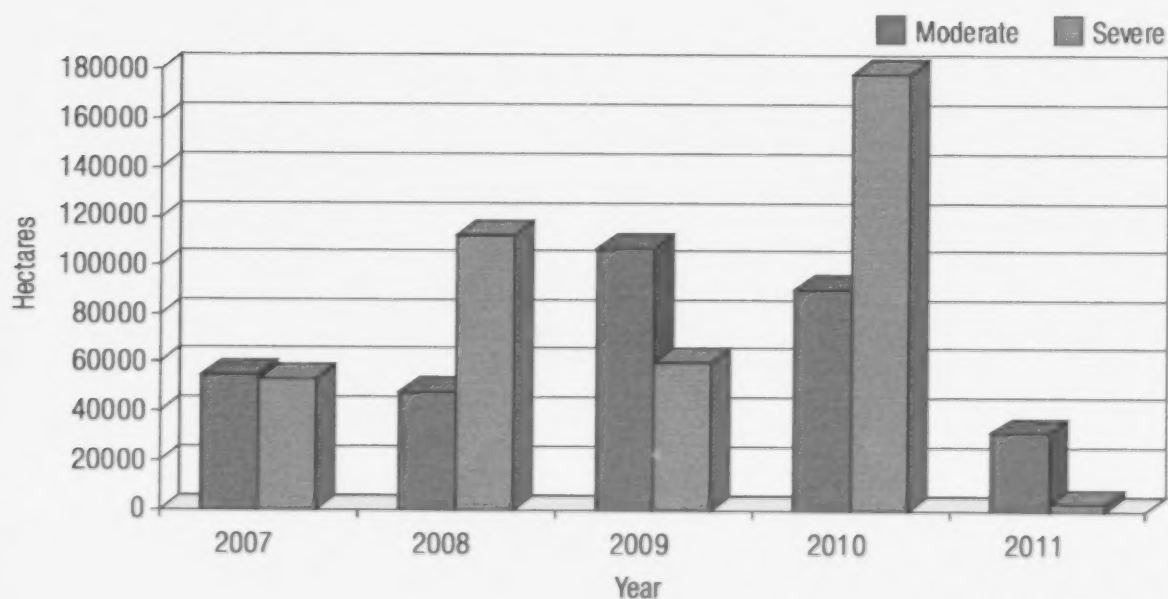


Figure 10.

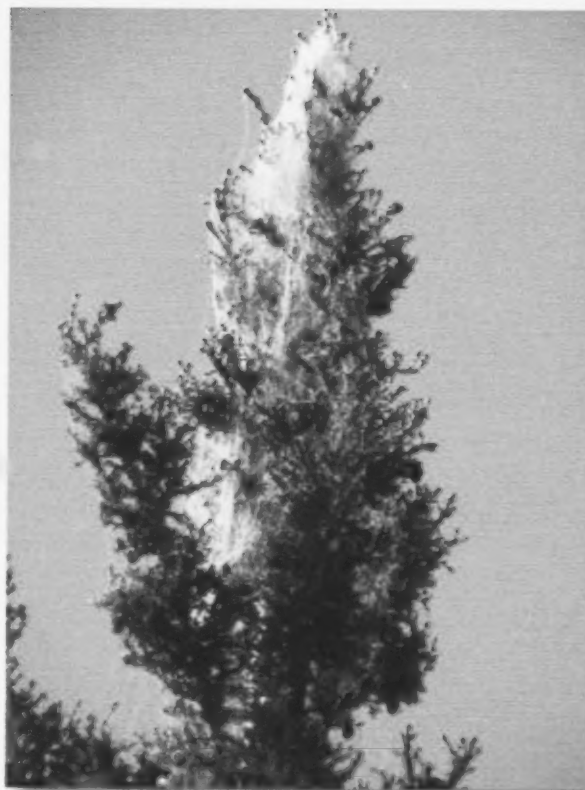
Spruce budworm defoliation by severity categories in Alberta, 2007 – 2011.



### Forecast for 2012

Multipher-I® traps baited with synthetic lures of female spruce budworm sex pheromone are used annually to monitor male budworm moth populations at strategically selected sites across forested Crown land in the Green Area<sup>4</sup>. In 2011, two traps with lures were placed at each of 159 trap sites located across the Green Area of the province. Surveys were completed at 156 of these sites. Figure 11 shows the results of these surveys.

The results of these surveys indicate that risk of spruce budworm outbreaks occurring in 2012 has decreased substantially, compared to that in 2011 (Figure 12). All the plots with high risk of outbreaks in 2012 are confined to northern Alberta infested by the eastern spruce budworm (Figure 13). One plot located in the Southern Rockies Area has a moderate risk of having an outbreak in 2012. This plot most likely is not inhabited by the two-year cycle budworm,



Severely budworm-infested white spruce tree

---

<sup>4</sup> Naturally Forested Area

*C. biennis*, because the average trap catches in this plot have consistently increased in the last three years from 105 to 1,100 per trap. With the two-year cycle budworm, trap catches are expected to go up and down in alternate years.



Figure 11.  
Forecasted risk of spruce budworm infestations occurring in 2012, based on moth catches in pheromone-baited traps in Alberta, 2011.

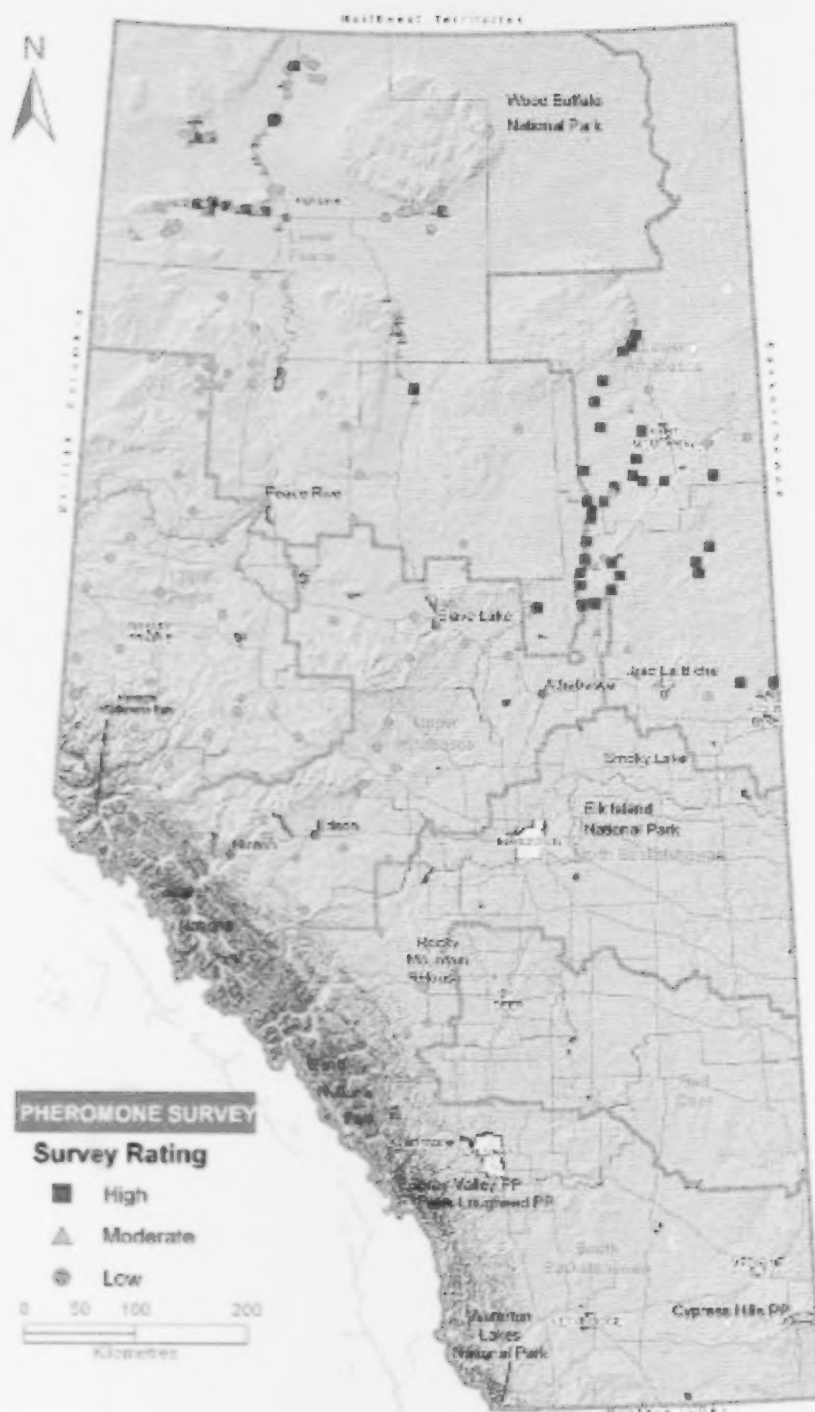


Figure 12.  
Forecasted risk of spruce budworm infestations occurring in 2011, based on moth catches in pheromone-baited traps in Alberta, 2010.

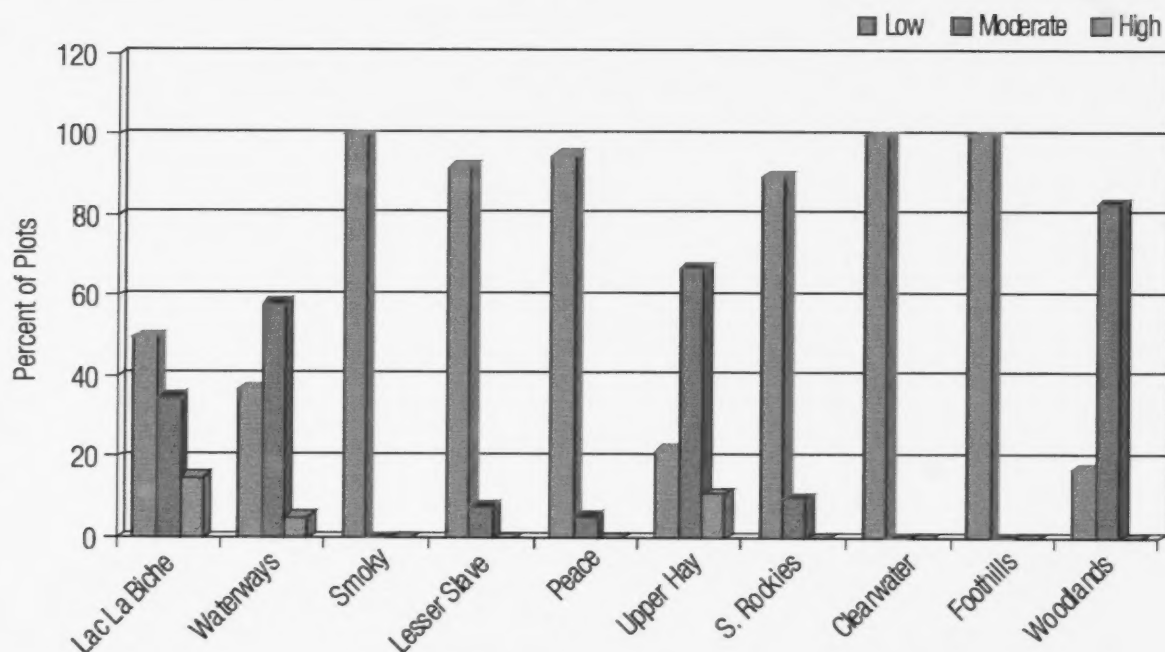


Figure 13.

Percent of pheromone-baited trap plots in each Forest Area that fall under each budworm outbreak risk category in 2012, Alberta.

## Spruce Budworm Management Program, 2011

### Assessment

A limited spruce budworm egg mass survey was carried out in October - November 2010 in 11 plots located in the Waterways Area because the male moth survey indicated high risk of outbreaks occurring in 2011. The intention of this survey was to delineate budworm-infested spruce stands for an aerial spray program. The results of this egg mass survey forecasted light to moderate defoliation occurring in 2011 in most of the plots.

A detailed second instar (L2) larval survey was carried out in January 2011 in 80 plots located in the same area to expand the scope and to verify the results of the egg mass survey. The L2 survey results corroborated those of the egg mass survey (Table 5). Based on the results of the detailed L2 survey, the proposed 35,000-hectare aerial spray program was

scaled down to an estimated 2,505 hectares of white spruce stands with high risk of outbreaks. The proposed spray areas were: reclaimed oil-sand lands at Gateway Hill (Figure 14), the Provincial Recreation Area and surroundings in Hangingstone and, Stony Mountain in northeast Alberta (Figure 15).

Table 5.

Results of a second instar (L2) larval survey carried out in January 2011 in northeast Alberta.

No. of Plots	Range of L2 Counts Per 10 m <sup>2</sup> of foliage	Expected Severity of Defoliation <sup>1</sup> in 2011
28 (35 per cent)	31 – 173	Light
38 (48 per cent)	193 – 526	Moderate
14 (17 per cent)	543 – 1,983	Severe

<sup>1</sup>Per cent defoliation of current-year needles in severity categories: Light = <35 per cent; moderate = 35-70 percent, and severe = >70 per cent

### Collaboration

The Forest Health Section of SRD led this aerial spraying project. The Alberta Tourism, Parks and Recreation (TPR) became a collaborator because the proposed spray area included Hangingstone Provincial Recreation Area that falls under their jurisdiction. In addition, the oil sands companies Suncor and Syncrude wanted to protect white spruce plantations growing on their reclaimed oil sands land. In view of this, a collaborative approach with TPR and oil sands industry was taken by SRD that led this project. This approach enabled to develop a common communication strategy and to share information on the spray program among the collaborators of this project.



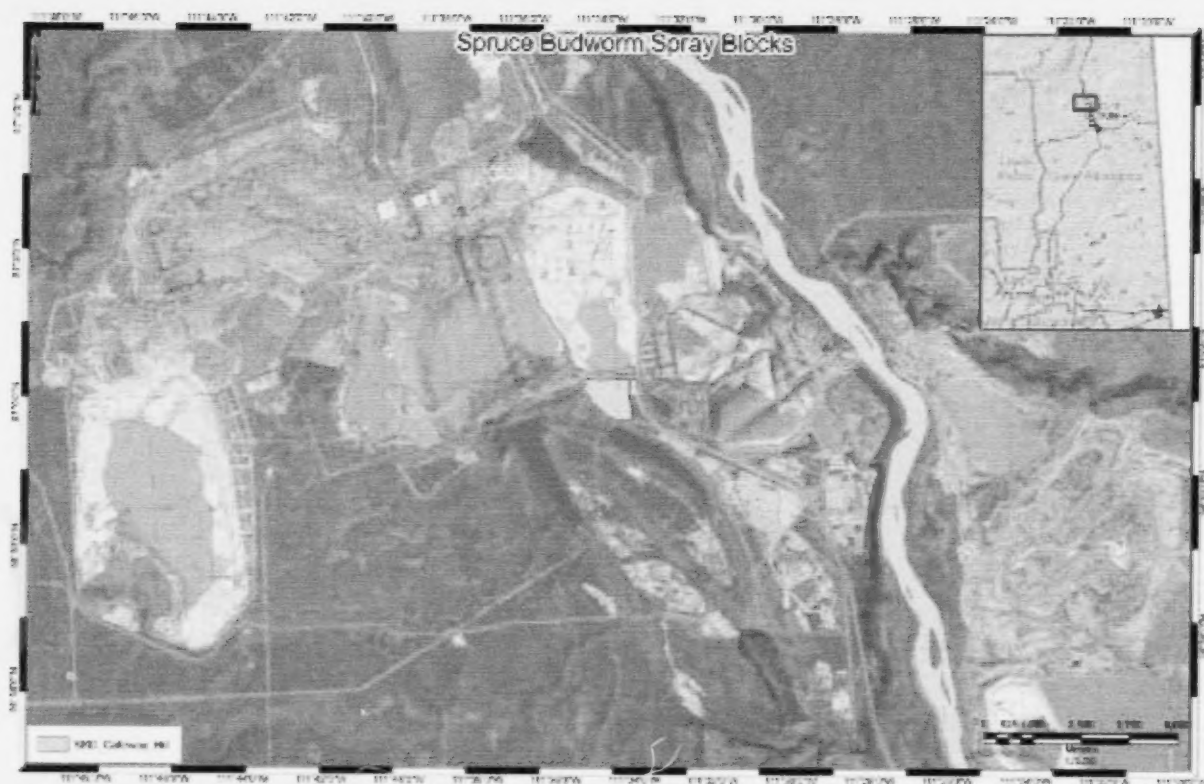


Figure 14.  
Gateway Hill aerial spray block, spruce budworm management program in northeast Alberta, 2011.

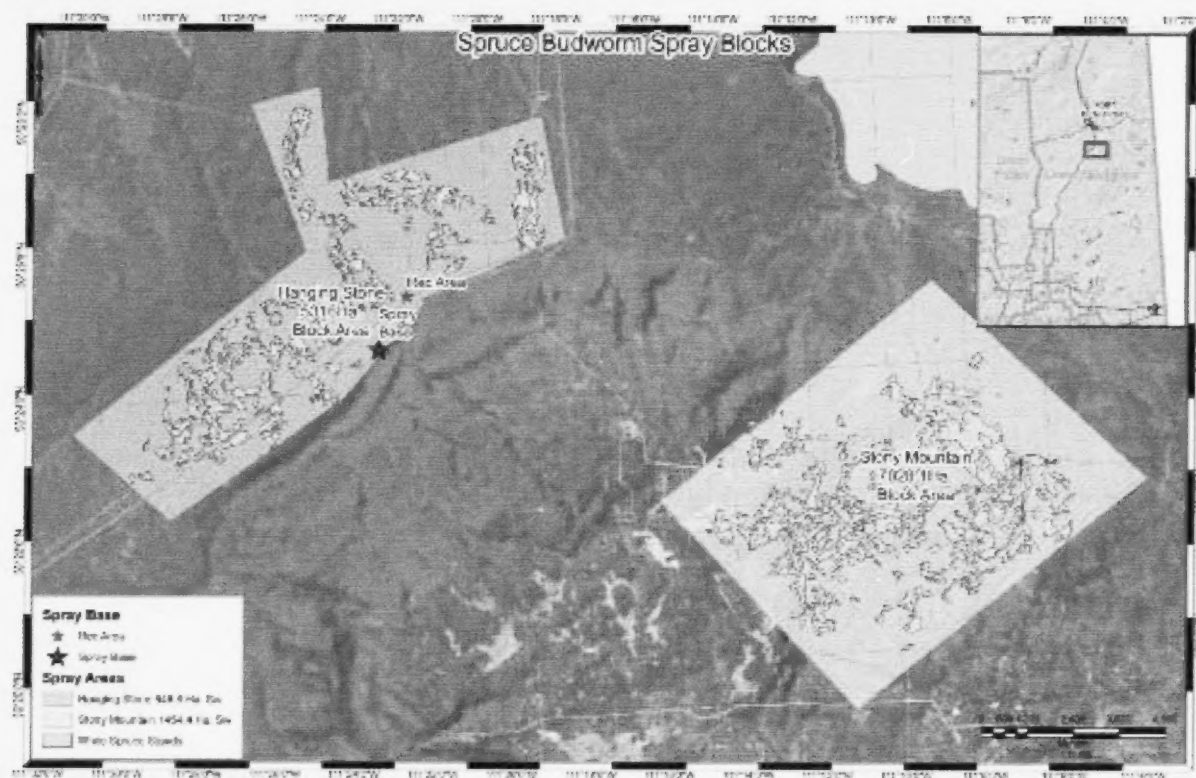


Figure 15.

Hangingstone and Stony Mountain aerial spray blocks, spruce budworm management program in northeast Alberta, 2011.

The main objective of this aerial spray program was to suppress the spruce budworm populations to an acceptable low level so that host trees could recover. The other objective was to protect economic and social values such as white spruce growing on reclaimed oil sands areas and white spruce in Hangingstone Recreational Area.

#### Aerial Spray Program

A pre-spray sampling was carried out on June 5, 2011 to assess the spruce budworm population levels before aerial spraying. To estimate budworm populations, a plot was established in each spray block.

The aerial spraying began on June 6 when the degree-day calculations indicated that most spruce budworms were at the fifth instar. A Btk formulation (Foray 48B®) was aerially sprayed twice, at the rate of 2.0 litres per hectare, over 2,750 hectares of budworm-infested white spruce stands in Gateway Hill, Hangingstone and Stony Mountain spray blocks. The second round of aerial spraying was completed on June 12th. The technical details of aerial spraying are summarized in Appendix II.

A post-spray sampling was carried out at Gateway Hill and Hangingstone plots on June 21, 2011. Stony Mountain plot was not sampled due to road inaccessibility following rainy weather.

### Results of the Spray Program in Relation to the Objectives

The pre- and post-spray numbers of spruce budworms were standardized by converting those to numbers per 10 m<sup>2</sup> of branch foliage. The standardized numbers were used to calculate the average number of spruce budworms in the sampling plots. The standardized pre- and post-spray numbers of spruce budworms per tree were used to calculate the average larval mortality in each plot. The average per cent larval mortality in Gateway Hill plot was 83.1 and that of Hangingstone plot was 85.9 (Table 6). Thus, the objective of suppressing the spruce budworm populations in the spray blocks was achieved. This lowering of spruce budworm populations will help spruce growing on sprayed areas of reclaimed oil sands land, Hangingstone Recreational Area and Stony Mountain to recover.



Helicopter used for aerial spraying  
(Note: mini-bulks with Btk)

Table 6.

The average larval mortalities in spruce budworm spray plots in Alberta, 2011.

Plot No.	Average Pre-spray larval count per 10m <sup>2</sup>	Average Post-spray larval count per 10 m <sup>2</sup>	Per cent larval mortality per tree	Mean per cent larval mortality per spray plot
Gateway Hill				
1	1,345	354	73.7	83.1
2	10,797	825	92.4	
Hangingstone				
1	2,658	145	94.5	85.9
2	3,743	276	92.6	
3	871	255	70.7	

### Western Spruce Budworm *Choristoneura occidentalis*

In 2011, the western spruce budworm defoliated an estimated 6,914 hectares in the South Saskatchewan LUF Region in southwest Alberta (Figure 16). This is more than double the 2,893 hectares defoliated by this pest in 2010 (Figure 17). Defoliation severity was light over 454 hectares, moderate over 6,435 hectares and severe over 25 hectares.

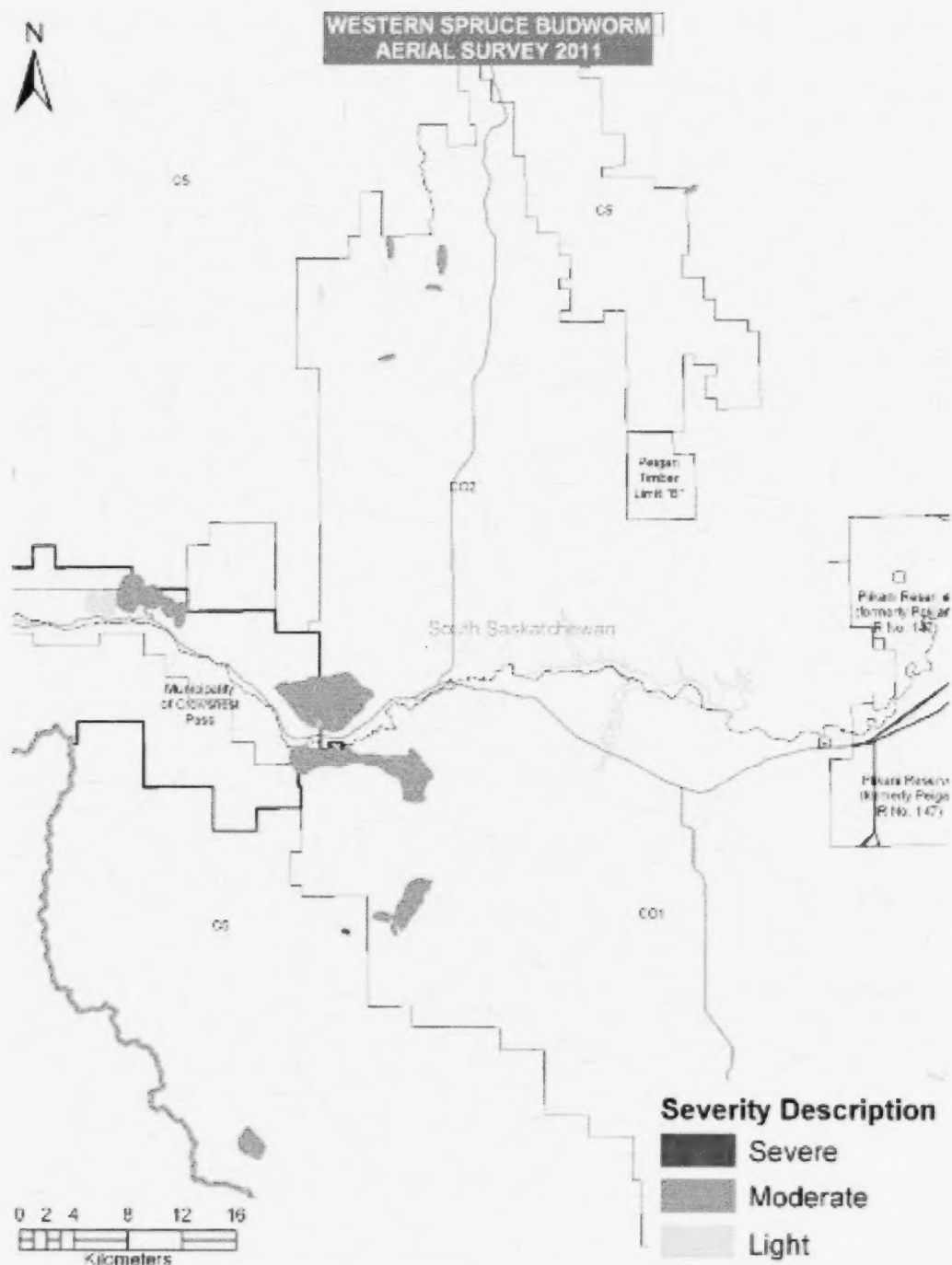


Figure 16.  
Spatial distribution of western spruce budworm defoliation observed in areas aerially surveyed in southwest Alberta, 2011.

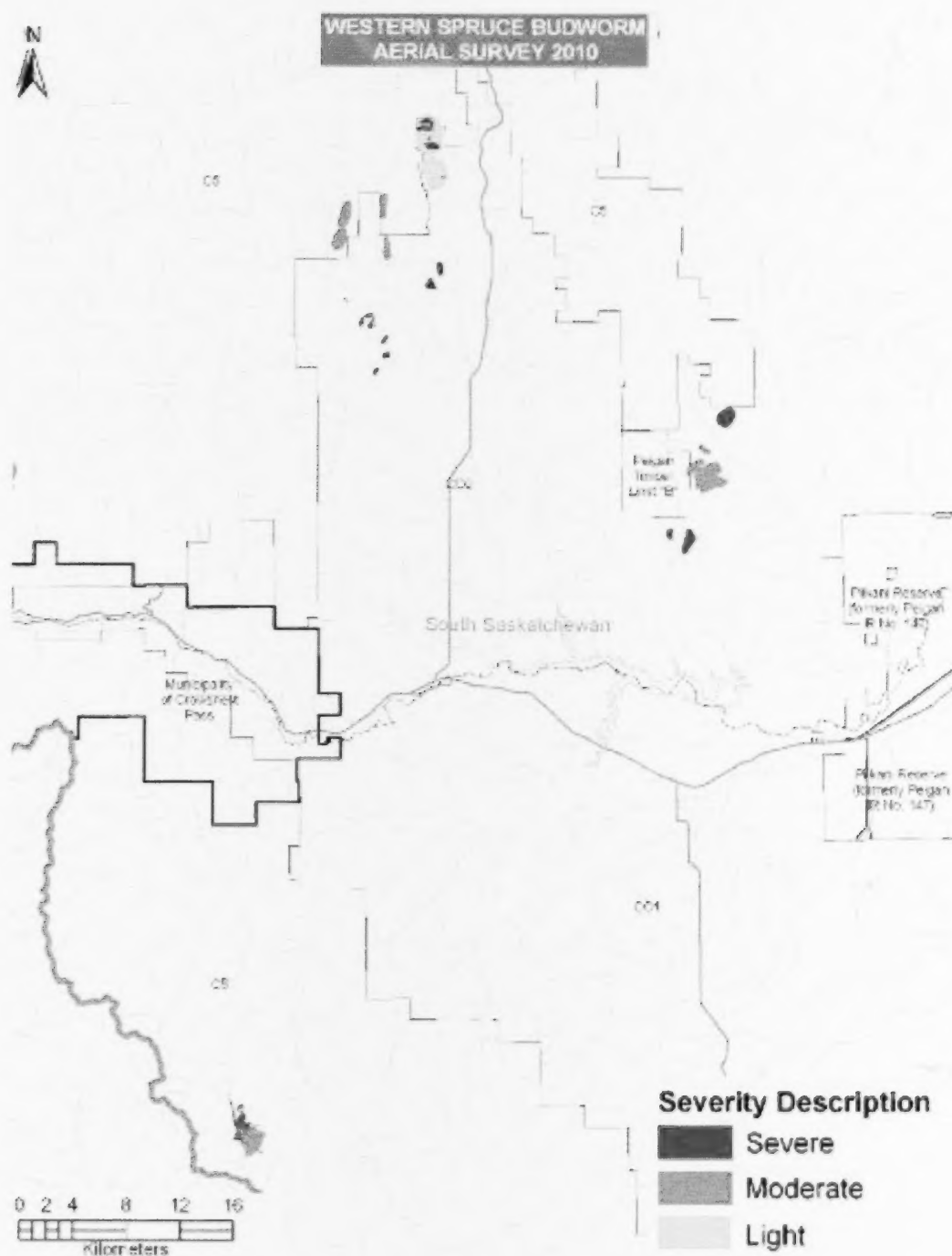


Figure 17.  
Spatial distribution of western spruce budworm defoliation observed in areas aerially surveyed in southwest Alberta, 2010.



## Broadleaf Defoliators

### Aspen Defoliators

#### Detection and Assessment

Forest Health Officers and/or Technicians carry out annual aerial overview surveys to record the gross area over which aspen defoliation is scattered and to estimate the intensity of defoliation by severity categories. The objective of this exercise is to maintain a historical record of insect pest-caused aspen defoliation in the Green Area of the province.

Figure 18 shows the results of these surveys. In 2011, aspen defoliation was scattered over an estimated gross area of 91,214 hectares. This is a 46 per cent increase of defoliated area, compared to 62,658 hectares defoliated in 2010. Defoliation was light over 37,967 hectares (41.6 per cent), moderate over 42,580 hectares (46.7 per cent) and severe over 10,667 hectares (11.7 per cent).

Table 7 shows the extent of 2011 aspen defoliation that was attributed to different pest species. The forest tent caterpillar (*Malacosoma disstria*) with defoliation scattered over an estimated 71,470 hectares was the predominant aspen defoliator in 2011. Defoliation by the Bruce spanworm (*Operophtera bruceata*), the predominant defoliator in 2010, was reduced by 65 per cent in 2011 to reach 17,947 hectares; defoliation by the large aspen tortrix (*C. conflictana*) remained at a low level and covered 1,797 hectares in 2011.

The severity of defoliation increased in 2011, compared to that in 2010 (Table 8).

### Other Broadleaf Defoliators

In 2011 summer, the willow leafminer, *Micruapteryx salcifoliella*, extensively defoliated willow stands in many parts of the Green Area. The caterpillars of this pest mine the inner layers of the leaves leaving necrotic blotches on leaves. The damage appeared severe and generated many queries from the general public who were concerned about willow stands. However, rarely do these insects kill their host stands.



Figure 18.  
Spatial distribution of aspen defoliation by severity categories observed in areas aerially surveyed in Alberta, 2011.

Table 7.

The extent (ha) of forest insect-caused aspen defoliation in 2011 by pest species, Alberta<sup>1</sup>

Pest	Light	Moderate	Severe	Total
Bruce Spanworm	17,688	259	0	17,947
Forest Tent Caterpillar	18,482	42,321	10,667	71,470
Large Aspen Tortrix	1,797	0	0	1,797
<b>Total</b>	<b>37,967</b>	<b>42,580</b>	<b>10,667</b>	<b>91,214</b>

<sup>1</sup> Excluding Wood Buffalo National Park and Prairies

: Forest tent caterpillar-defoliated trembling aspen stand

Table 8.

The extent (ha) and severity of forest insect-caused aspen defoliation by Land-Use Framework regions in Alberta, 2010 vs. 2011.

LUF Region	Defoliation Severity 2010			TOTAL 2010	Defoliation Severity 2011			TOTAL 2011
	Light	Moderate	Severe		Light	Moderate	Severe	
Lower Athabasca	507	184	0	691	2,555	0	0	2,555
Upper Athabasca	944	162	0	1,106	18,255	313	17	18,585
Lower Peace	8,939	1,528	0	10,467	2,202	121	0	2,323
Upper Peace	50,327	0	0	50,327	14,955	42,146	10,650	67,751
North Saskatchewan	8	0	0	8	0	0	0	0
South Saskatchewan	0	59	0	59	0	0	0	0
<b>Total</b>	<b>60,725</b>	<b>1,874</b>	<b>0</b>	<b>62,658</b>	<b>37,967</b>	<b>42,580</b>	<b>10,667</b>	<b>91,214</b>

## Abiotic Tree Damaging Agents

### Disorders

Several disorders caused by abiotic damaging agents affected forest trees in Alberta in 2011. The affected areas were recorded during aerial overview surveys. Figure 23 shows locations of forest stands affected by these disorders. The details of these disorders are described below in the alphabetical order:

#### Aspen Dieback

Relatively small patches of aspen dieback were recorded during aerial surveys conducted in 2011. In the Upper Athabasca LUF Region, aspen dieback was light over 465 hectares and moderate over 139 hectares. In the Upper Peace LUF Region, 69 hectares had moderate aspen dieback. In the South Saskatchewan LUF Region, aspen dieback was

moderate over 1,124 hectares and severe over 58 hectares. The exact cause of this aspen dieback is not determined but it is most likely a combined effect of pest damage and drought stress.

#### Drought Damage

Drought caused extensive damage to forest stands in central Alberta in 2011. In the Lower Athabasca LUF Region, drought damage was light over an estimated 8,922 hectares, moderate over 37,959 hectares and severe over 29,018 hectares. Damage was more extensive in the Lower Peace LUF Region where an estimated 305,257 hectares of forest stands were affected. In this region, damage was light over



Drought-affected aspen stands in NE Alberta, 2011

303,434 hectares, moderate over 735 hectares and severe over 1,088 hectares. In the Upper Peace LUF Region, drought damage was light over 14,957 hectares, moderate over 7,776 hectares and severe over 4,783 hectares.

### Hail Damage

In 2011, some hail damage was recorded in the Upper Athabasca and Upper Peace LUF regions. Hail damage in 2011 was neither as severe nor as extensive as that in 2010. In the Upper Athabasca LUF Region, hail damage was light over 126 hectares, moderate over 5,362 hectares and severe over 133 hectares. Moderate hail damage was recorded over 756 hectares in the Upper Peace LUF Region.

### Red Belt

Red belt was rather common during 2011 winter along the Rocky Mountain Range in western Alberta. The reddish tree crowns of pines caused by red belt led to some false reporting of mountain pine beetle incidence in those stands. The pine stands affected by red belt were surveyed during aerial overview surveys. Red belt was most extensive in the South Saskatchewan LUF Region where it was moderate over 28,346 hectares and severe over 29 hectares.

In the Upper Peace LUF Region, red belt was light over 76 hectares and moderate over 319 hectares. In the Upper Athabasca LUF Region, red belt was light over



Red belt in pine stands

126 hectares, moderate over 624 hectares and severe over 72 hectares. In the North Saskatchewan LUF Region, light red belt was observed over 975 hectares.

### Wind Damage

Wind damage over relatively small patches of forest was recorded in the Upper Athabasca LUF Region. This damage was light over 104 hectares and moderate over 381 hectares. Severe wind damage was also observed on a small patch of six hectares in the Upper Peace LUF Region.

These wind-damaged stands will be monitored in 2012 as potential centres of wood borer and spruce beetle populations.



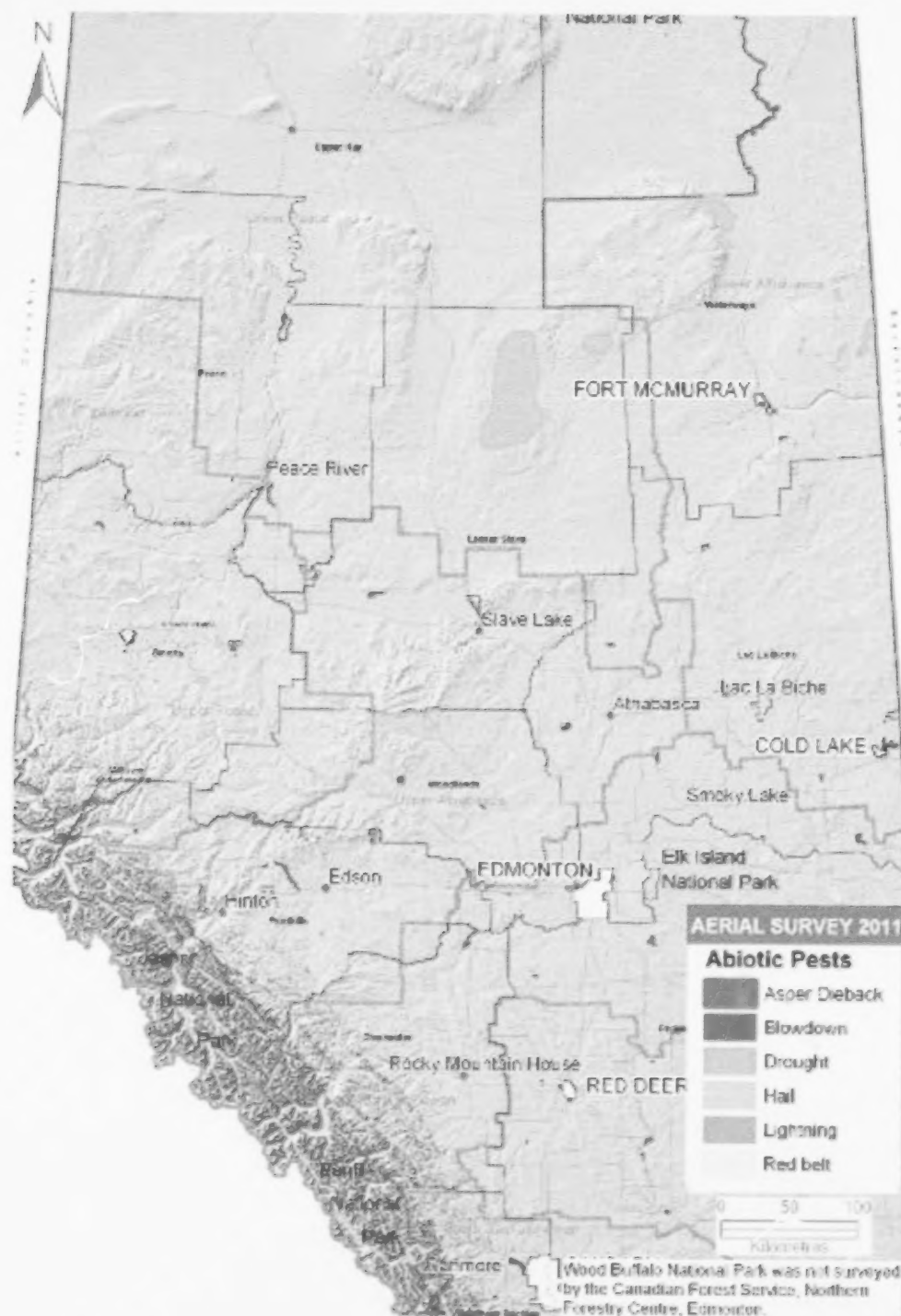


Figure 19.  
Locations of forest stands affected by abiotic damaging agents observed during aerial overview surveys in Alberta, 2011.

## 2011 Invasive Plant Species Program

### Introduction

This program deals with invasive plant species that occur in the Green Area of the province. Relatively large areas with noxious or prohibited noxious invasive plants growing on unoccupied Crown land were the focus of this program.

This year, the following strategy objectives were fulfilled under this program:

- survey to detect the presence and extent of noxious or prohibited noxious invasive plant species at selected sites in the Green Area of the province;
- management of invasive plants on SRD occupied sites and on vacant Crown land, as required by the Weed Control Act;
- initialization and/or continuation of localized weed cooperative projects within designated areas with high value and high probability of success;
- early detection and rapid response to invasive plants that occur at relatively low levels and/or new infestations on vacant public land or at high value sites; and,
- ongoing education and increased awareness initiatives.

### Invasive Plant Detection and Distribution Surveys

Table 9 contains a list of invasive plant species that were observed during ground surveys carried out at selected sites in the Green Area in 2011. The survey sites in 2011 included SRD facilities such as cabins, camp grounds, wildfire bases and staging areas, and fire lookout tower sites as well as vacant Crown land such as random camp sites, abandoned forestry roads and quad trails.

Figures 20-24 show occurrences of five invasive plant species at selected sites in the Green Area monitored in 2011, in relation to their historic survey information. However, these surveys did not systematically cover the whole Green Area of Alberta due to fiscal and labour constraints. Within the surveyed areas, Canada thistle, tall buttercup, scentless chamomile and oxeye daisy were the predominant invasive plant species found in 2011. Infestations of Hawkweed, a prohibited noxious weed, in the Upper Athabasca (Foothills Area) and South Saskatchewan (Southern Rockies Area) LUF regions increased significantly in 2011.

### Invasive Plant Management

In 2011, SRD in conjunction with municipalities and industry partners carried out several projects to manage invasive plant species in the Green Area. Biological, ecological, herbicidal and mechanical methods were used in these management programs. Weed management co-ops formed by SRD, industry and municipality partnerships led to successful weed management programs in 2011.

The Canada Thistle Mining Weevil (*Ceutorhynchus litura*) was released in 2011 to control Canada thistle at four sites in the Woodlands Area of the Upper Athabasca LUF Region. These sites were chosen because of their close proximity to water and likelihood to remain undisturbed.

Altogether 1,500 weevils were released at these four sites. These sites will be re-visited in 2012 to evaluate overwinter survival of weevils and their success in Canada thistle control.



Canada Thistle



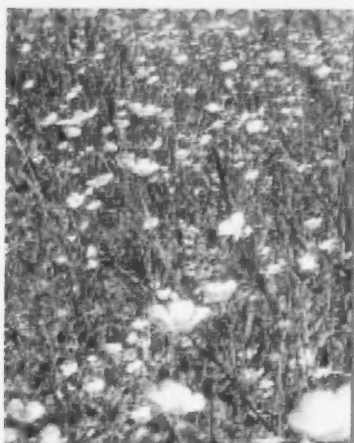
Figure 20.  
Distribution of Canada thistle in relation to its historical occurrence at selected survey sites in the Green Area of Alberta, 2011.



Scentless Chamomile



Figure 21.  
Distribution of Scentless Chamomile in relation to its historical occurrence at selected survey sites in the Green Area of Alberta, 2011.

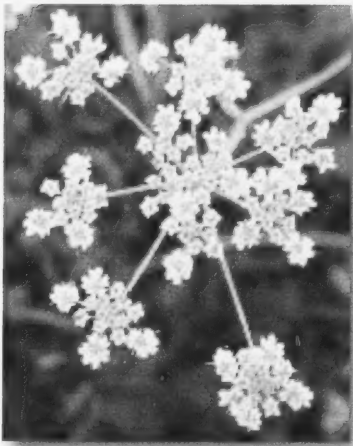


Tall Buttercup



Figure 22.  
Distribution of Tall Buttercup in relation to its historical occurrence at selected survey sites in the Green Area of Alberta, 2011.





Wild Caraway



Figure 23.  
Distribution of Wild caraway in relation to its historical occurrence at selected survey sites in the Green Area of Alberta, 2011.



Oxeye Daisy



Figure 24.  
Distribution of Oxeye Daisy in relation to its historical occurrence at selected survey sites in the Green Area of Alberta, 2011.

Table 9.

Invasive plant species observed at selected sites surveyed in the Green Area of Alberta in 2011

Common Name	Scientific Name	Occurrence <sup>1</sup>
Black henbane	<i>Hyoscyamis niger</i> L.	3
Blueweed	<i>Echium vulgare</i> L.	3
Canada thistle	<i>Cirsium arvense</i> (L.) Scop.	1, 2, 3, 6
Common mullein	<i>Verbascum Thapsus</i> L.	3
Common tansy	<i>Tanacetum vulgare</i> L.	1, 2, 3
Common toadflax	<i>Linaria vulgaris</i> Hill.	3
Dalmatian toadflax	<i>L. dalmatica</i> L.	3
Diffuse knapweed <sup>2</sup>	<i>Centaurea diffusa</i> Lam.	3
Field scabious	<i>Knautia arvensis</i> (L.) Duby	3
Hound's tongue	<i>Cynoglossum officinale</i> L.	3
Meadow hawkweed <sup>2</sup>	<i>Hieracium caespitosum</i> Dumort.	2, 3, 4
Orange hawkweed <sup>2</sup>	<i>Hieracium aurantiacum</i> (L.)	1, 2, 3, 6
Ox-eye daisy	<i>Chrysanthemum leucanthemum</i> L.	1, 3
Perennial sow-thistle	<i>Sonchus arvensis</i> L.	2
Scentless chamomile	<i>Matricaria perforata</i> Merat.	1, 2, 3, 5
Spotted knapweed <sup>2</sup>	<i>Centaurea maculosa</i> Lam.	3
Tall buttercup	<i>Ranunculus acris</i> L.	1, 2
Wild caraway	<i>Carum carvi</i> (L.)	1, 3

<sup>1</sup> Forest Areas: 1. Clearwater 2. Smoky 3. Southern Rockies 4. Foothills 5. Waterways/Lac La Biche 6. Woodlands .<sup>2</sup> Prohibited noxious invasive plants

In an effort to use the ecological method of Successional Advancement, i.e., use of another plant species to successfully smother invasive plants, willow stakes and poplar plugs were planted over an area known as the "gravel pit" stubbornly infested with scentless chamomile in the Amadou Lake area, Lower Athabasca LUF Region. If successful, this will be a long-term, environmentally friendly technique to manage invasive plants in forested areas.

Numerous patches of invasive plants detected (Table 11) across the Green Area were sprayed with herbicides in 2011. These areas included SRD facilities and vacant Crown lands. Among the herbicides used

were 2, 4-D Amine 600; Vanquish; Banvel; Milestone and 2, 4-D Amine mix; Grazon; 6:1 mix of Arsenal and Milestone and, a mixture of vinegar, salt and soap solution.

Mechanical control by hand pulling was also used to manage invasive plants with tap roots growing at vacant Crown lands and SRD sites such as wildfire lookouts; wildfire bases; warehouse compounds; and, a fuel-cache site. In 2011, noteworthy mechanical control use sites were Amadou Weed Co-op site where industry partners hand-pulled nearly a ton of invasive plants; West Castle Weed Pull where SRD staff and several groups of volunteers helped to pull invasive plants; and "Pull a Weed Day" in Cadomin.

### Invasive Plant Co-operatives

In the North Saskatchewan LUF Region (Clearwater Area), three co-operative spray projects were completed by a weed co-op that is composed of two forest companies, one utility company and five oil and gas companies; these cooperative projects achieved effective weed control in the Clearwater Area. In the Lower Athabasca LUF Region, Amadou Weed Co-op in the Lac La Biche Area had another successful year where SRD, oil and gas companies and forest companies used ecological and mechanical means to markedly reduce weed infestations in Lake Amadou Area. McKay River Weed Co-op in the Waterways Area, a consortium of ten oil and gas companies, had its first meeting in 2011. This Co-op is expected to begin weed management in 2012. In the Foothills Area of the Upper Athabasca LUF region, Yellowhead County and SRD collaborated under the Yellowhead Invasive Plants Initiative to efficiently control invasive plants in this area. In the Southern Saskatchewan LUF Region (Southern Rockies Area), SRD plans to enter into a Memorandum of Understanding with the Municipal District of Crowsnest Pass to have an efficient and an effective invasive plant control program.

### Education and Increased Awareness

The annual Northeast Weed Co-op Workshop was the highlight of numerous programs carried out in 2011 to educate the general public and stakeholders to increase their weed awareness. This workshop was conducted for the sixth consecutive year in Athabasca. The County of Athabasca co-hosted this event with the Lac La Biche/Upper Hay Area of the Lower Athabasca LUF Region. Suncor, Ace Vegetation and Dow Agrosciences were the other sponsors of this workshop. In spite of a busy wildfire season, 72 people attended this event. The attendees viewed presentations on invasive plant identification, biology and management options; new weed introductions; details on upcoming weed control products; biological control; seed analysis and benefits of co-operative weed management. The workshop attendees who are members of the professional bodies either earned

relevant continuing competency credits or earned recertification credits.

Among the other activities that educated and increased weed awareness were public information sessions conducted at the Edson Golf Course for Conoco Phillips employees; open houses held at community centres under the patronage of Yellowhead Invasive Plants Initiative; "Pull a Weed Day" in Cadomin; and "Park Day" held in William A. Switzer Park, organized by the Foothills Area of the Upper Athabasca LUF Region.

SRD staff made several presentations to increase weed awareness of Wildfire Crews; Mountain Pine Beetle Crews; Lands Forest Officers; and, Junior Forest Ranger Crews.

In addition, custom-made Invasive Plant Awareness Signs were erected at the Eagle Creek Campground and at the Medicine Lake Random Camp in the Clearwater Area of the North Saskatchewan LUF Planning Region. Invasive Plant Pamphlets were made available to the general public at various locations in the Foothills Area.

### Collaborative Programs

#### Gypsy Moth Detection Surveys

In 2011, the Forest Health Section of SRD deployed 55 Delta traps baited with lures to detect presence of the gypsy moth in the Green Area of Alberta. This was a part of the province-wide gypsy moth detection program organized by the Canadian Food Inspection Agency (CFIA). The locations of these gypsy moth traps are shown in Figure 25. No gypsy moths were trapped by SRD in 2011.





Figure 25.  
Locations of gypsy moth traps deployed by SRD in Alberta, 2011.



### Monitoring of Climate Impacts on the Productivity and Health of Aspen (CIPHA)

The Forest Health Section of Alberta Sustainable Resource Development (SRD) is monitoring the CIPHA sites in Alberta under a cooperative interagency agreement with the Natural Resources Canada (NRCAN). The intent of this project is monitoring and carrying out research on climate-related impacts on forest health. This collaboration began in 2010 with the two agencies signing a Letter of Agreement on this project.

The Canadian Forest Service of NRCAN began establishing and monitoring of CIPHA plots in 2000 for examining interactions between climate, insects and diseases, and trembling aspen. Currently, CIPHA sites are established in the provinces from British Columbia to Ontario and in the Northwest Territories.

In Alberta, there are nine CIPHA nodes. In 2011, SRD monitored 7 out of 9 nodes; The Canadian Forest Service monitored the two remaining nodes.

At each plot, each aspen tree with a diameter at breast height (DBH) >7cm was examined from vantage points. The surveyors recorded data on defoliation, dieback, foliage compliment and, signs and symptoms of damaging agents.

### Whitebark- and Limber Pine Recovery Plan

The Forest Health Section of the Forestry Division and the Fish and Wildlife Division of Alberta Sustainable Resources Development are co-leading a project to develop a recovery plan to protect whitebark pine and limber pine.

These five-needled pines are keystone species that play key roles as important, nutritious sources of food for birds and mammals. These species were designated as Endangered under the Alberta Wildlife Act in 2009 because they are under threat by a fungal disease (white pine blister rust) and an insect pest (mountain pine beetle).

Recovery efforts in 2011 centered on a) tree health assessments in collaboration with Alberta Tourism, Parks and Recreation and b) establishment of plots to monitor regeneration of these pine species following prescribed fires, in collaboration with the Forest Protection Branch. Alberta Tree Improvement and Seed Centre has identified sites to collect seeds of these species. The Forest Health Section and Parks Canada have co-funded a project by the University of Calgary on using remote sensing to develop habitat maps for both of these pine species.

### Increased Awareness and Training

#### National Forest Pest Strategy MPB workshop

From November 15-17, 2011 the Forest Management Branch of Sustainable Resource Development (SRD), under the auspices of the Canadian Council of Forest Ministers, hosted a national workshop on mountain pine beetle (MPB) management and spread risk. Forest management executives and forest health professionals from across Canada met for three days in Edmonton and Hinton to experience and discuss the potential impacts of, and management responses for western Canada's most destructive forest pest.

At this workshop various government, industry and academic forest professionals discussed the ecological implications, risk assessments and MPB management effectiveness. Alberta participants spoke about the partnerships, planning and industry initiatives in place.

The workshop was a huge success and a learning experience to understand the complexities arising in the complex MPB management issue.

## Provincial Forest Pest Management Forum - 2011

The 15th Annual Integrated Forest Pest Management Forum was held on November 3rd at the Northern Forestry Centre, Canadian Forest Service in Edmonton. Nearly 60 people representing forest industry, academic institutions, forest health research community and all three levels of government participated in this Forum.

The proceedings included updates on the status of major forest health damaging agents on provincial land and national parks. Current research on the mountain pine beetle and tree resistance; current status and recovery of whitebark and limber pines; invasive and exotic forest pests; and, forest pathology issues were discussed at this forum.

## Forest Health Newsletter

The Forest Health Section published four issues of the quarterly publication entitled "*Bugs and Diseases*" that informed forest industry personnel and the general public on Forest Health related issues in Alberta. Each issue of this newsletter carried articles on current topics of interest to the forest health community.

## Appendix I

## Land-use Framework Planning Regions and Corporate Areas in Alberta, 2011.



## Appendix II

## Technical Details of the Aerial Spray Program

**Insecticide**

Trade name:	Foray 48B
Active Ingredient:	<i>Bacillus thuringiensis</i> sub-species <i>kurstaki</i>
PCP Registration No:	24977
Formulation:	Water-based
Guaranteed potency:	12.7 BIU per Litre (=10,500 International Units per mg)
Delivery:	1000-litre mini-bulk

**Aircraft**

Make:	Hiller UH12 ET
Spray Capacity:	350 litres of Btk per load
Flow meters:	Crophawk 7B
Guidance System:	TRIMBLE TrimFlight3
Atomizers:	4 Beecomist 361A rotary atomizers

**Aerial Spraying**

Spray Dates:	June 6-8 and June 11-12, 2011
Spray Speed:	80 km/h
Swath Width:	40 meters
Rate of Spraying:	2.0 litres per hectare
VMD:	60 – 80 microns
Deposit Assessment:	ADAM kit & Kromekote Cards
Weather Parameters:	Temperature 6.5 – 22 °C; RH 35 – 89%; Wind 2-10 km/h

